

Do you REPAIR CAR BODYWORK?

Please read this
- important
information for
you!



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Work right – avoid isocyanates.

Information for people who work in car or truck body repair workshops

In recent years in Sweden, new hazards have been found to be associated with paint used for repair of car bodywork and other chemical products that are manufactured with isocyanates and which contain PUR (polyurethane). When PUR is heated, toxic compounds – isocyanates – are produced which can harm the respiratory system. Such heating occurs in repair of car and truck bodywork, e.g. when welding, cutting and grinding.

The isocyanate levels may be high, so high that they can cause asthma. Measurements made in the past with old methods have almost always shown low levels of isocyanates. New measuring methods show that the levels can be very high. The reason is that the old methods do not detect all the different isocyanates that can be generated when materials containing PUR are heated.

High levels of isocyanates can cause asthma. There are suspicions, moreover, that the respiratory system can be affected by very short-term exposures to high concentrations. In the worst-case scenario, a few breaths of smoke from something containing PUR can be sufficient to harm the airways. Such exposures are not unusual in the repair of car and truck bodywork.

Might I become ill?

Isocyanates can give rise to a range of symptoms. The most usual ones consist of respiratory problems, e.g. nasal congestion, runny nose, dry cough or nose bleeding. Diffuse symptoms such as eye irritation, headaches or feeling heavyheaded also occur. Lung function may be impaired, which is most noticeable in the form of heavy breathing in conjunction with physical exertion or loss of stamina. It

may sometimes be difficult to identify impaired lung function oneself, but a doctor can measure it. The symptoms may arise at work, but they may also only be noticeable several hours after work. They usually disappear after a few days away from work. Severe cases may involve asthma, which is life-long. Every time one is exposed to isocyanates one can suffer an asthma attack. Asthma may also mean that the airways become more sensitive to dust and odours. This means that an asthma attack can be triggered by such things as perfume, exhaust emissions or solvents. Isocyanates can also cause contact dermatitis. Conditions involving the above symptoms, particularly asthma, can - in the EU at least – be registered as occupational injuries if they can be linked with exposure to isocyanates.

In recent years, a research project has been conducted by the Swedish Environmental Research Institute, in collaboration with organisations including the Metalworkers Union, the Transport group/Motor Industry Employers' Association and the Work Environment Authority ¹⁾.

A large number of measurements have been done to investigate the levels of isocyanates which occur and the jobs which cause them. Measurements have also been done to determine the efficiency of various measures taken.

In this publication, we have summarised what we know at present, and how you can protect yourself from isocyanates. This publication covers isocyanates produced by hot work, i.e. cutting and welding. Other isocyanate work is also mentioned, but is not covered in detail.

Please read this and think about the measures which would need to be taken at your workplace to protect you from isocyanates caused by hot work.

1) The reference group has included representatives from the Bilskadecenter in Enköping, SAAB Automobile AB, Folksam, Folksam Auto, the Unit for Industrial Environment and Chemistry at Lund University and Assist.nu Effektiv Produktion AB

It must work out in daily work!

The measures needed to be taken to work safely will affect your daily work. You might need to do jobs in a different way. New tools may be necessary, or you may have to use tools in a different way. For most people, it takes time to change your habitual work practices. If you are going to succeed, everybody involved will have to join in and develop new work methods.

- ✘ Discuss why work methods have to be changed, and the advantages this offers. How important is it? Does everybody know about the risks associated with isocyanates? Has anybody at your workplace felt any of the symptoms caused by isocyanates? ²⁾
- ✘ Review all hot work which occurs frequently and less frequently. Where is it done? How do smoke and grinding sparks from hot work spread through the workplace?
- ✘ Review the things which are easy to change and which are described in this brochure. Do the necessary changes.
- ✘ Give yourself time to get used to new tools and work methods (but do not worry - the changes we suggest are not difficult to implement and work with).
- ✘ Keep on working with the problems which remain to be solved and decide about the changes you are going to make.

2) Isocyanates mostly affect breathing passages. Do you want to know more? Read Prevent's brochure "Do you work with Isocyanates and Polyurethane?"



It is important to know the risks

Repair technicians and supervisors involved with vehicle body repair should have had special training regarding the risks related to work with isocyanates. Thanks to this training, you learn more about the risks involved in work and how to protect yourself.

Anybody who works with vehicle body repair should have a medical examination at regular intervals, so that the signs of isocyanate injury can be discovered quickly. Work which involves exposure to isocyanates includes;

- ✘ Body painting
- ✘ Bonding of windscreens and sheet metal

- ✘ Applying body filler and working with undersealing compounds which contain isocyanates (please refer to the goods information sheets/safety data sheets)
- ✘ Hot work. If PUR (polyurethane) material (e.g. car paint, plastics or dampener) is heated to over 150-200°C, the material starts to decompose and isocyanates are formed. The hotter it gets, the more isocyanates are formed. The isocyanate which forms the highest levels is isocyanic acid. Examples of hot work are welding, hot aligning and cutting with a cutter. Isocyanates may also be formed during grinding.

Did you know?

- ✘ That if paint is discoloured or starts to bubble, isocyanates have been formed.
- ✘ Hazardous levels of isocyanates may have been formed even if the paint looks undamaged.
- ✘ Isocyanates can be formed even if you do not see any smoke.
- ✘ You can be exposed to levels above the hygienic limit, especially if you lean over a workpiece during welding, shrinking, aligning, hard soldering or when working on bumpers containing PUR damping material. When you cut or grind, the exposure levels can be high, especially if the air stream from the tool is directed towards the repair worker.
- ✘ Isocyanates are only one kind of air pollution which is formed. The other pollutants can also be a health hazard.

Choose effective measures which are easy to use!

A good workplace forms the foundation

The work of protecting yourself from isocyanates goes hand in hand with having a tidy workplace and good quality.

Is the workplace designed so that you can work safely and with good quality?

- ✘ There should be a high ceiling, since this makes it easier to ventilate the premises.
- ✘ General ventilation should function satisfactorily. The air flow should be 3.5 l/s for every m² of floor space (13 m³/hour per m² of floor space). The ventilation should be checked regularly, so that its efficiency does not drop off. Measure the air flow and check how the air moves in the premises. Are the entire premises ventilated adequately? Are there air streams (such as from air treatment plant or open doors), which could spread isocyanates from hot work to other workplaces on the premises?
- ✘ Recirculated (return) air must not occur. (Recirculated air means that the air which is extracted from the premises is sent back again. This is a particularly common practice in winter, to save energy).
- ✘ There should be local exhausts on moving arms, which should be easy to pull out and position up to 30 cm away from sources of contamination, such as when you are doing hot work. The diameter of the extraction opening should be at least 25 cm, and the air speed at the

opening should be at least 3 m/s.) It is an advantage if the local exhaust has a flow monitor, to warn if air flow in the device is too low. There should be a sufficient number of local exhausts and they should reach the places where they might be needed.

- ✘ There should be access to high vacuum system, so tools can be provided with integrated exhausts. One requirement is that there is a high vacuum installation and that vacuum pipes have been installed at all work-places where work with integrated exhaust is carried out.

Also remember that:

- ✘ A good working stance is important. Good means that you can work standing upright, without having to lean in towards or over the work site, which may result in high exposures to isocyanates. Avoid work below waist level. Easily operated car hoists are essential for finding an ergonomic working position.

Remember this when you do any kind of hot work!

Local exhaust

Use a local exhaust whenever work causes smoke or dust, and make sure that the exhaust is in the best possible position. Remember to:

- ✘ Position the local exhaust as close as possible, and not more than a foot away. It should not be possible to get your head in between the hot work and the extraction device.

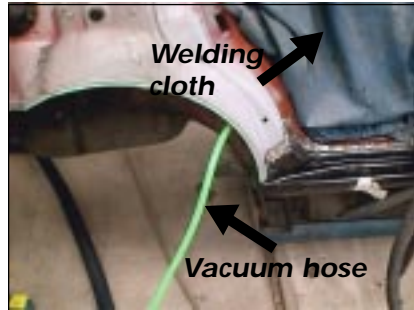
- ✘ Position the local exhaust so that it catches any smoke or spray from your hot work. Smoke often rises. Some tools, such as cutting and grinding machines, can eject smoke in a different direction. When the hot work site moves, such as when you are welding a seam, move the extraction device along when you work

Examples of the extraction capability of a local exhaust.

	Only smoke	Smoke and heat
Smoke released at various distances right under the extraction device.	Smoke is trapped up to 500 mm below the device.	Smoke is trapped up to 500 mm below the device.
Smoke released at various distances right under the extraction device, but displaced 300 mm to one side of the device	Almost all smoke is trapped up to 300 mm below the device.	Not much smoke is trapped by the device

- ✘ If smoke is formed on the rear of a panel (i.e. inside box sections, inside bodywork or from the painted rear of a panel which can not be sanded clean) set up an extraction device (such as an extra extraction device or hose from the high vacuum supply) and put it against the rear of the panel/inside the vehicle. Sometimes you will have to shield the area with welding cloth and put the extractor between the cloth and the panel. A small exhaust is enough to catch most of the smoke which comes from the rear of a panel and via box sections, please refer to the illustration.

Smoke extraction from a box section, using a vacuum hose, during resistance spot welding. Welding cloth is used for shielding. No smoke spreads from the rear/inside of the box section.



Sanding down

It is important to remove the paint, to give the best quality repair work. Before you start to do hot work, it is important to sand the paint off as carefully as possible, before you start work. If there is no paint on the panel, no isocyanates can be formed. The paint should be removed for at least 30 mm and preferably 50 mm from each side of the work site. Sometimes there will be paint left behind on the rear or in box sections of the bodywork, which is difficult to remove – this is when isocyanates can be formed.

Actions to take in some of the jobs

MIG welding



There is a newly developed and very easily used welding torch with integrated fume capture nozzle. The integrated exhaust in combination with sanding down, gives a good protection against isocyanates. The welding gun with the integrated

exhaust is sold by ESAB. When purchasing such a device, please make sure that a valve for regulation of the flow is included. The valve is mounted on the welding device. If integrated exhaust in combination with a local exhaust can not be used in a good manner, a breathing mask with compressed air supply should be used.

Cutting

In the first instance, use tools which do not produce so much heat that isocyanates are formed. The best tool is a circular saw with a rotating blade. When they tried them, auto bodywork repairers thought that they worked well. In other cases, you can use a jigsaw, but it makes more noise. If these tools are used, it is not necessary to sand the metal down or use breathing protection. A point air extractor should be used to catch the dust which is created.



Circular saw with rotating blade, Atlas Copco, model LCS10 (max 10 mm cutting depth) does not produce any isocyanates and does not make as much noise as a reciprocating saw (jigsaw).

High speed, small cutter with integrated extractor for connection to a high vacuum system.



High speed cutters should be used if it is not possible to cut with a circular saw with rotating blade, or a jigsaw. If a high speed machine does have to be used, it should have

an integrated extractor. In addition, the sheet metal needs to be sanded down first, and an integrated air extraction device used. If the cutter is not equipped with a hood connected to the high vacuum installation, contact the manufacturer. If they do not have a suitable hood with integrated exhaust, contact Nederman Nordic AB (+46-16-16 07 50).

Sanding/grinding

When you are planishing large, relatively flat areas, an orbital sander with integrated air extraction connected to high vacuum system is the best choice. Breathing protection is not then needed.



Orbital sander with integrated extraction for connection to a high vacuum installation.

When sanding paint away before welding, i.e. sanding down much smaller areas and when grinding down the weld bead after welding, you can use a small belt sander or a small rotating sander with a "Scotch Brite" wheel. A tool with integrated exhaust should be used to suck up as much of the dust formed as possible, or the hose from a high vacuum installation should be held beside the tool.

- ✘ Local exhaust should be used in all sanding/grinding work.
- ✘ Large high speed cutters and grinders without integrated exhausts should not be used, since they spread too much air pollution.

- ✘ If the regular machine supplier cannot supply integrated exhausts to rotating sanders with Scotch Brite or belt sanders, contact Nederman Nordic AB (+46-16-16 07 50).



Upper illustrations. A small, rotating sander with a "Scotch Brite" wheel.



Belt sander. If these sanders are used – use tools with integrated extraction or hold the hose from a high vacuum installation beside the tool

Resistance spot welding, hard soldering, shrinking and hot alignment

There are no tools available for resistance spot welding, hard soldering, shrinking and hot alignment. For this reason, it is important that the person who does this kind of work should use some kind of breathing protection (please refer to page 16 (breathing protection)).

Tests of integrated exhaust for resistance spot welding has shown that it is possible to control isocyanate emissions. However, we do not know of any supplier of resistance spot welding equipment who provides integrated exhausts or such exhausts as fittings. Please contact your spot welder supplier and explain that you are interested in buying equipment with an integrated exhaust connection to high vacuum system

To reduce the spread of smoke in the premises, you should.

- ✘ Use a local exhaust.

- ✘ Shield the hot work off with welding cloth. Shielding allows the local exhaust to catch the smoke more efficiently, at the same time as the fire risk is reduced.
- ✘ Sand at least 50 mm clear on each side of the work site.
- ✘ If necessary, put a vacuum hose or exhaust extractor on the rear as an extra protection.

Large jobs where there is a risk of extremely high formation of isocyanates should be done at a time when there is nobody else on the premises, with time allowed for the smoke to be ventilated away before anybody else enters the premises. Alternatively, the work should be done in a separate room. Examples of such large jobs are different kinds of shrinking.

Lead loading

Lead loading will probably be prohibited in body repair shops, since solder contains lead. (According to EU Directive 2000/53/EU which comes into force in 2003, lead will be prohibited in new cars.)

Removing spot welds

Spot weld sites for plug welding should preferably be drilled away (not ground off). If they are difficult to drill away, make a mark with a centre punch in the middle of the spot weld, to make it easier to get a grip with the drill, or use a drill bit with centre point. Use a point air extractor during drilling as well.

Plastic work

Never use a hot air gun when working on PUR plastics material.

Never saw through a bumper which contains PUR damping material. Replace it by a bumper with a ready-made opening for a towbar instead.

If an infra-red lamp is used, wipe the tubes off before switching on, if the tubes look dusty.

What does all this cost?

Many body repair workshops already have a high vacuum installation. The cost of new tools with integrated extraction, or supplementary extraction for existing machinery is comparatively low, not more than SEK 5 000:-/tool (2002 prices). The report entitled "Effective measures against isocyanates in vehicle workshops" gives an approximate cost for the measures.

When breathing protection needs to be used

A breathing mask with compressed air supply gives the best protection against isocyanates and other air pollution, and works well on condition that 1) the hose is long enough so that the mask can be used where needed, 2) the mask is available when needed and 3) the air supply is heated.

An alternative to a breathing mask with compressed air supply is a fan-supplied respirator with combined filter containing a particle trap and active carbon filter. The filters must be changed regularly, for the fan-supplied respirator to give good protection, which means that they are expensive to use in the long run. A fan-supplied respirator gives good protection as long as there is excess pressure inside the mask.

Both a breathing mask with compressed air supply and a fan-supplied respirator are personal equipment and should be tried out by each person who uses them. They should be stored in such a way that they do not get dirty. Since the filter in a fan-supplied respirator is used up if it comes into contact with air pollution, it is important that it is stored in a clean environment, in a plastic bag.

Stopping the spread of pollution to other workplaces

One measure which has been discussed is to use separate rooms. Body repair technicians are frequently positive to using separate rooms/screened areas since they reduce noise, weld flash etc. Separate rooms are also needed for working with un-hardened products which contain isocyanates, such as painting.

The best measures for preventing the spread of isocyanates to other workplaces and for protecting the person doing hot work is to prevent isocyanates from being formed, or to catch them as close as possible to the source.

If you can not use the best methods, well-designed separate (but not shielded) areas could be a good way to reduce the spread of isocyanates to surrounding areas. The repair technician who does the work will still have to use breathing protection and not remove the breathing protection until the isocyanates and other air pollution have been thoroughly ventilated away (i.e. not right after the job is finished).

If you want to read more about separate rooms (with permanent partitions) and shielded areas (using curtains etc.), read more in the report entitled "Effective measures against isocyanates in vehicle workshops".



One example of a separate room. The walls are permanently fixed and one side consists of a roll-up door. There are no large openings so isocyanates are not spread to surrounding work-places. If you use methods which produce isocyanates or spread them to the workplace, you will need breathing protection.

An example of a screened area. The walls consist of some kind of curtain, and there are large openings in the ceiling and other places, which means that isocyanates caused by hot work can easily be spread outside the screen and reach other workplaces. If you use methods which produce isocyanates or spread them to the workplace, you will need breathing protection.



Do you want to read more?

Do you work with ISOCYANATES and POLYURETHANE? Part no. 5220

Self Diagnosis (check list)

Part no. 294, available on www.prevent.se

“Do you work with isocyanates and polyurethane?” can be ordered free of charge from Prevent, exchange phone no. +46 8-402 02 00. Both materials can be downloaded from the Internet and printed out as a pdf file from, www.prevent.se, in English, under Services.

Effective measures against isocyanates in vehicle workshops

Do you want to read more about the measures for vehicle bodywork repair? The report entitled “Effective measures against isocyanates in vehicle workshops” (in Swedish with an English summary) IVL report B1501 November 2002 can be downloaded from the IVL web site, www.ivl.se, search under reports. It can be read and printed out free of charge.

Materials available in Swedish / Swedish regulations

Work, body life in the motor trade – a CD-ROM and training material which has been prepared in collaboration between the Motor Industry Employers’ Federation, the Metalworkers’ Union and the Painter’s Union. There is also a web site for this training material, www.jklsupport.nu. This material is available only in Swedish.

Work Environment Authority regulations related to isocyanates are:

- Hard Setting Plastics, AFS 1996:4 (this edition is being revised)
- Chemical Industrial Environment Risks, AFS 2000:4
- Hygienic limits and measures against air pollution AFS 2000:3
- Workplace design, AFS 2000:42, contains rules for ventilation etc.

These regulations can be ordered from the Work Environment Authority, SE-171 84 Solna. The same regulations can be downloaded free of charge from the Internet and printed out from www.av.se. This site also contains an isocyanate fact page and link collection to other documents.

Chemical Hazards

Training material from Prevent
www.prevent.se (phone: +46 8-402 02 00).

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